

WHAT IS CLAIMED:

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1. An isolated nucleic acid encoding an evening primrose  $\Delta 6$ -desaturase.

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2. The isolated nucleic acid of Claim 1 comprising at least one of the nucleotide sequence of SEQ ID NO: 26 or nucleotides 49 to 1401 of SEQ ID NO: 26.

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3. An isolated nucleic acid that codes for the amino acid sequence of SEQ ID NO: 27.

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4. A vector comprising the nucleic acid of any one Claims 1- 3.

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5. An expression vector comprising the isolated nucleic acid of any one of Claims 1-3 operably linked to a promoter which effects expression of the gene product of said isolated nucleic acid.

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6. An expression vector comprising the isolated nucleic acid of any one of Claims 1-3 operably linked to a promoter and a termination signal capable of effecting expression of the gene product of said isolated nucleic acid.

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7. The expression vector of Claim 5 wherein said promoter is a  $\Delta 6$ - desaturase promoter, an Anabaena

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carboxylase promoter, a helianthinin promoter, a  
1 glycinin in promoter, a napin promoter, the 35S  
promoter from CaMV, a helianthinin tissue-specific  
promoter, an oleosin seed-specific promoter, or an  
albumin seed-specific promoter.

5 8. The expression vector of Claim 6 wherein  
said promoter is a  $\Delta 6$ -desaturase promoter, an Anabaena  
carboxylase promoter, a helianthinin promoter, a  
glycinin promoter, a napin promoter, the 35S promoter  
10 from CaMV, a helianthinin tissue-specific promoter, an  
oleosin seed-specific promoter, or an albumin seed-  
specific promoter.

15 9. An expression vector comprising the  
isolated nucleic acid of any one of Claims 1-3 operably  
linked to a constitutive promoter.

20 10. An expression vector comprising the  
isolated nucleic acid of any one of Claims 1-3 operably  
linked to a tissue specific promoter.

25 11. The expression vector of Claim 6 wherein  
said termination signal is a Synechocystis termination  
signal, a nopaline synthase termination signal, or a  
seed termination signal.

12. A cell comprising the vector of Claim 4.

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13. A cell comprising the vector of Claim 5.  
14. A cell comprising the vector of Claim 6.

15. The cell of Claim 12 wherein said cell is an animal cell, a bacterial cell, a plant cell or a fungal cell.

16. The cell of Claim 13 wherein said cell is an animal cell, a bacterial cell, a plant cell or a fungal cell.

17. The cell of Claim 14 wherein said cell is an animal cell, a bacterial cell, a plant cell or a fungal cell.

18. A transgenic bacterium or plant comprising the isolated nucleic acid of any one of Claims 1-3.

19. A transgenic bacterium or plant comprising the vector of Claim 4.

20. A transgenic bacterium or plant comprising the vector of Claim 5.

21. A transgenic bacterium or plant comprising the vector of Claim 6.

22. A plant or progeny of said plant which  
1 has been regenerated from the plant cell of Claim 15.

23. The plant of Claim 22 wherein said plant  
is a sunflower, soybean, maize, tobacco, peanut, carrot  
5 or oil seed rape plant.

24. A method of producing a plant with  
increased gamma linolenic acid (GLA) content which  
comprises:

- 10 (a) transforming a plant cell with the  
isolated nucleic acid of any one of Claims 1-3; and  
(b) regenerating a plant with increased GLA  
content from said plant cell.

15 25. A method of producing a plant with  
increased gamma linolenic acid (GLA) content which  
comprises:

- (a) transforming a plant cell with the vector  
of Claim 4; and  
20 (b) regenerating a plant with increased GLA  
content from said plant cell.

26. A method of producing a plant with  
increased gamma linolenic acid (GLA) content which  
25 comprises:

- (a) transforming a plant cell with the vector  
of Claim 5; and

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(b) regenerating a plant with increased GLA  
1 content from said plant cell.

27. A method of producing a plant with  
increased gamma linolenic acid (GLA) content which  
5 comprises:

(a) transforming a plant cell with the vector  
of Claim 6; and

(b) regenerating a plant with increased GLA  
content from said plant cell.

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28. The method of Claim 24 wherein said  
plant is a sunflower, soybean, maize, tobacco, peanut,  
carrot or oil seed rape plant.

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29. The method of Claim 25 wherein said  
plant is a sunflower, soybean, maize, tobacco, peanut,  
carrot or oil seed rape plant.

30. The method of Claim 26 wherein said  
20 plant is a sunflower, soybean, maize, tobacco, peanut,  
carrot or oil seed rape plant.

31. The method of Claim 27 wherein said  
plant is a sunflower, soybean, maize, tobacco, peanut,  
25 carrot or oil seed rape plant.

32. A method of inducing or increasing  
production of gamma linolenic acid (GLA) in an organism.

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lacking in or producing low levels of GLA which  
1 comprises transforming said organism with the isolated  
nucleic acid of any one of Claims 1-3.

33. A method of inducing or increasing  
5 production of gamma linolenic acid (GLA) in an organism  
deficient or lacking in or producing low levels of GLA  
which comprises transforming said organism with the  
vector of Claim 4.

10 34. A method of inducing or increasing  
production of gamma linolenic acid (GLA) in an organism  
deficient or lacking in or producing low levels of GLA  
which comprises transforming said organism with the  
vector of Claim 5.

15 35. A method of inducing or increasing  
production of gamma linolenic acid (GLA) in an organism  
deficient or lacking in or producing low levels of GLA  
which comprises transforming said organism with the  
20 vector of Claim 6.

36. A method of inducing production of gamma  
linolenic acid (GLA) in an organism deficient or  
lacking in or producing low levels of GLA and linoleic  
25 acid (LA) which comprises transforming said organism  
with an isolated nucleic acid encoding bacterial  $\Delta 6$ -  
desaturase and an isolated nucleic acid encoding  $\Delta 12$ -  
desaturase.

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37. A method of inducing production of gamma  
1 linolenic acid (GLA) in an organism deficient or  
lacking in or producing low levels of GLA and linoleic  
acid (LA) which comprises transforming said organism  
with at least one expression vector comprising an  
5 isolated nucleic acid encoding evening primrose  $\Delta 6$ -  
desaturase and an isolated nucleic acid encoding  $\Delta 12$ -  
desaturase.

38. The method of inducing production of  
10 octadecatetraeonic acid in at least one of a plant  
deficient or lacking in or producing low levels of  
octadecatetraeonic acid, a bacterium which produces  $\alpha$ -  
linolenic acid, or a bacterium which exhibits a  $\Delta 15$ -  
desaturase activity on a GLA substrate which comprises  
15 transforming said plant or bacterium with any one of  
Claims 1-3.

39. A method of inducing production of  
octadecatetraeonic acid in at least one of a plant  
20 deficient or lacking in or producing low levels of  
octadecatetraeonic acid, a bacterium which produces  $\alpha$ -  
linolenic acid, or a bacterium which exhibits a  $\Delta 15$ -  
desaturase activity on a GLA substrate which comprises  
transforming said plant or bacterium with the vector of  
25 Claim 4.

40. A method of inducing production of  
octadecatetraeonic acid in at least one of a plant

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deficient or lacking in or producing low levels of  
1 octadecatetraenoic acid, a bacterium which produces  $\alpha$ -  
linolenic acid, or a bacterium which exhibits a  $\Delta 15$ -  
desaturase activity on a GLA substrate which comprises  
transforming said plant or bacterium with the vector of  
5 Claim 5.

41. A method of inducing production of  
octadecatetraenoic acid in at least one of a plant  
deficient or lacking in or producing low levels of  
10 octadecatetraenoic acid, a bacterium which produces  $\alpha$ -  
linolenic acid, or a bacterium which exhibits a  $\Delta 15$ -  
desaturase activity on a GLA substrate which comprises  
transforming said plant or bacterium with the vector of  
Claim 6.

15 42. A method of inducing production of  
octadecatetraenoic acid in at least one of a plant  
deficient or lacking in or producing low levels of  
octadecatetraenoic acid, a bacterium which produces  $\alpha$ -  
20 linolenic acid, or a bacterium which exhibits a  $\Delta 15$ -  
desaturase activity on a GLA substrate which comprises  
transforming said plant or bacterium with the vector of  
Claim 7.

25 43. The method of Claim 40 wherein said  
plant is a sunflower, soybean, maize, tobacco, peanut,  
carrot or oil seed rape plant.

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44. The method of Claim 41 wherein said  
1 plant is a sunflower, soybean, maize, tobacco, peanut,  
carrot or oil seed rape plant.

45. The method of Claim 42 wherein said  
5 plant is a sunflower, soybean, maize, tobacco, peanut,  
carrot or oil seed rape plant.

46. The method of Claim 43 wherein said  
plant is a sunflower, soybean, maize, tobacco, peanut,  
10 carrot or oil seed rape plant.

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